

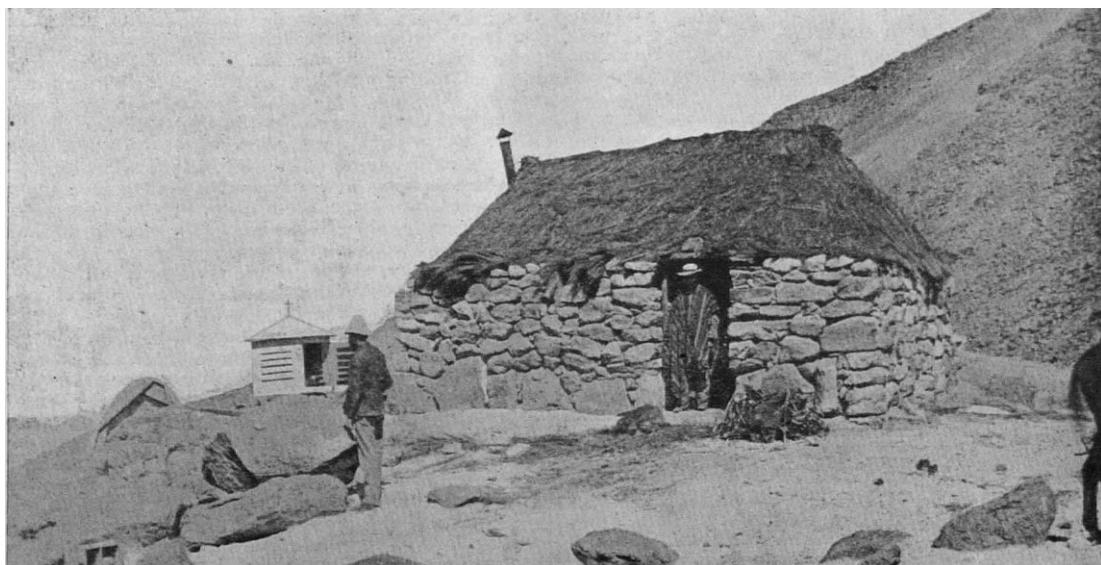
names might as legitimately be transferred to the latter as many of the names in use in the Alps and elsewhere. An interesting point brought out is the fact that all the snowy *massifs* lie on the main water-parting of the range. As regards its geology, the theory of a volcanic origin may be absolutely excluded, there being only one spot in the whole upper region at which even local traces of basaltic veins were seen. The evolution of the range may be ascribed to (1) an upheaval *en masse* of a portion of the Archaean floor of Central Africa; (2) to a highly accentuated anticlinal uplift, ellipsoid in form, with strata more or less tilted in the central group; (3) the presence in this of a series of rocks (amphibolites, diorites, &c.) far more resistant than the gneisses and mica-schists of the outer ranges. Evident traces were seen of the enormous development of glaciers in the Ice age, while at present they are of the second order only, on the upper slopes and in the larger ravines. They are all, at the present moment, in retreat. The snow-line seems to be at about 14,400 feet. Among other results of the expedition, various new species of birds, molluscs, insects, crustacea, &c., were collected, though the fauna of the upper region was naturally poor.

The Duke showed a praiseworthy caution in identifying

behind Arequipa, and ascended the main Chachani summit to an altitude of 18,000 feet, being satisfied that the ascent could be completed. In January, 1892, Prof. Pickering established a station at the Chachani Ravine at an altitude of 16,650 feet. An attempt was made in December to start a station on the main summit, but when Prof. Pickering and Mr. Goodair reached a height of 18,800 feet the Indians who were carrying the instruments and baggage deserted, and the attempt failed. The Chachani Ravine station was visited about once a month during 1892, and discontinued in 1893.

In October, 1893, a station was erected on the summit of the Misti Volcano, and in December another lower down on the eastern flank, the altitudes being 19,200 feet and 15,600 feet respectively. In 1895 observations were also taken at an altitude of 13,300 feet.

These stations constituted a chain from the sea coast over the western Cordilleras, and in order to continue this chain across the Andes, Prof. Solon I. Bailey, in July, 1894, started a station at Cuzco, in the valley between the western and eastern Cordilleras. The instruments were established in the yard of a brewery, and one of the employees commenced observations in July.



The Meteorological Station at the Chachani Ravine (16,650 feet).

the range with the "Mountains of the Moon," in spite of the obvious allurements of the notion, to which so many of his predecessors have succumbed.

At the conclusion of the address the King, in a short speech, expressed the thanks of the assembly to the Duke, whom he congratulated upon his successful expeditions in tropical and polar regions.

METEOROLOGY IN PERU.¹

IN 1892 Prof. W. H. Pickering and others of the staff of the Arequipa Observatory were trying to establish meteorological stations in Peru, a region which up to the present has not been very well represented in meteorological observations. The meteorological station at Mollendo had been discontinued during 1890 and 1891, but observations were resumed there and at Arequipa during the early part of 1892, and in March a station was established at La Joya, a town midway between these two places.

In December, 1891, Messrs. Douglas and Goodair made a journey of inspection past the Chachani Ravine,

After an unsuccessful attempt to secure a station to the east of Cuzco, Prof. Bailey went on northward, using mules and encountering many difficulties on the way. Very often the shelters and instruments had to be carried by hand under the low branches of trees and overhanging rocks, which would otherwise have struck them from the backs of the mules. At Santa Ana Prof. Bailey met one of the estate owners, who willingly agreed to make the observations in his own grounds, and did so for more than a year.

The various stations were all fitted with Richard barographs and thermographs, standard and maximum and minimum thermometers, &c. Observations were also made of rainfall, clouds, winds, and of occasional phenomena.

At Mollendo, La Joya, and Cuzco observations were made at 8 a.m., 2 p.m., and 8 p.m. each day, but at Santa Ana only at 8.0 a.m. At the mountain stations observations were made only at intervals of about ten days by various members of the Arequipa staff.

In the volume under notice only eye observations have been discussed, the automatic records being left for a future volume. So also are all the Arequipa records.

An examination of the thermometer records shows that the annual range of mean temperature at the lower stations is small, being largest at Mollendo on the coast,

¹ "Annals of the Astronomical Observatory of Harvard College," Vol. xxxix, part ii., Peruvian Meteorology, 1892-5. By Prof. Solon I. Bailey.

where the range is from $59^{\circ}9$ F., in August, to $71^{\circ}6$ F., in February, only $11^{\circ}7$ F., whilst at Cuzco the range is only $6^{\circ}1$ F.

At Mollendo and La Joya, both west of the mountains, the south and east winds predominate very largely, whilst at Cuzco and Santa Ana there is no marked preponderance of wind from any particular quarter.

During the period April, 1892, to December, 1895, the total rainfall at Mollendo was 2.65 inches, the mean annual rainfall being 0.66 inch. At La Joya, which is in the middle of the desert of Islay, no measurable rain fell during the whole period, that is, never did more than one two-hundredth of an inch fall on any one day. On the average there are eight days per year on which some rain falls. The annual rainfall at Cuzco is 38.58 inches, and the rainfall for the year July, 1894, to June, 1895, at Santa Ana was 51.71 inches.

All the observations made by eye are given in full, and are well summarised. The dated remarks which accompany the tables prove very interesting reading, especially those referring to the high stations, and show well the difficulties encountered in making observations at these altitudes, exposed to wind and cold, and apparently also to robbers, for on September 6, 1894, it is recorded that at the Misti summit station the doors of the hut and shelter were found open, and that the barograph, thermometers, and tools had been stolen!

As an appendix an account is given of the moving sand dunes of the desert of Islay. Scattered over this desert are thousands of these crescent-shaped dunes. They are all of one form, and have always the same orientation, with the convex side to the south winds and the cusps pointing north and north-west.

Prof. Bailey measured one of these dunes near La Joya in 1894. The points were 160 feet apart, and the length round the convex side was 477 feet. Its maximum width was more than 100 feet, and the weight was estimated as more than 8000 tons.

Between March, 1892, and March, 1894, it had travelled 125 feet, and by March, 1896, a further 120 feet. From that date until January, 1901, monthly measures were taken, and in the five years it travelled 294 feet at an average rate of more than 5 feet per month. A comparison of the record of movement and the record of strong south winds shows that these winds are the sole cause of the northerly movement of these sand dunes. W. M.

THE ASSOCIATION OF ECONOMIC BIOLOGISTS.

ON Wednesday, January 9, the annual meeting of the Association of Economic Biologists opened at Cambridge, and continued until Friday, January 11. The conferences were held by kind permission of the medical staff in the pathological department of the University, and the laboratories in this department and also the zoological laboratory were thrown open for the occasion, and members also had the opportunity of visiting the botanical department.

Mr. A. E. Shipley, F.R.S., was elected president of the association for 1907 in the place of the retiring president, Mr. F. V. Theobald, who with Sir Patrick Manson, K.C.M.G., and Prof. W. Somerville, will act as vice-presidents for the year.

In his presidential address Mr. Shipley dealt with the subject of sea fisheries. He gave an interesting account of this important subject, and dwelt on the necessity of constant investigation. No less than 27,000 vessels are engaged in this industry, employing 90,000 men, fishing from British ports, the capital invested being estimated at 11,000,000. He referred to the partial failure of the herring fishery last summer, and to the numerous inquiries that had been held concerning such matters, reckoning no less than seventeen in the last seventy years.

The president is of opinion that time is not yet ripe for deep-sea fishing legislation, on account of our knowledge still being so deficient that it does not yet form a sound basis for law making. The North Sea fisheries are

those upon which our energies must be mainly expended. Fishermen and experts have long held that the grounds are being depleted, and the latest report of the Board of Agriculture and Fisheries bears out these statements.

Mr. Shipley then mentioned various experiments that had been carried out in Norway and on the Dogger Bank. Some interesting figures regarding fish reproduction were quoted, showing their enormous sexual powers; for instance, the turbot produced annually $8\frac{1}{2}$ million eggs and the cod $4\frac{1}{2}$ million.

The chief possible causes of impoverishment were summed up as follows:—(1) the accumulated stocks of the Dogger and Iceland grounds had been fished out; (2) any given area of sea could support but a limited quantity of produce; and (3) the excessive destruction of young fish. In spite of the grave nature of the North Sea problem, it is satisfactory to learn that the condition of the fishing industry generally was never more prosperous than at the present time. It is hoped that sufficient funds will be forthcoming to continue the excellent scientific work in this subject that has already been done.

Prof. Nuttall's paper on red-water fever and allied diseases was full of interesting matter. After explaining the results of his investigations into the life-history of the Piroplasmæ he dealt with the various diseases caused by them, dwelling particularly on the results of his experiments on canine piroplasmosis. In connection with this paper Prof. Nuttall and Mr. Warburton had prepared a most interesting exhibition of ticks, and the parasites they convey.

The first day's proceedings finished with a paper by Mr. R. H. Biffen on his well-known work on cereal breeding.

The first paper on Thursday was one by Mr. F. V. Theobald on some new hemipterous fruit pests. Illustrated by lantern-slides, the life-history and damage caused by leaf-hoppers (*Typhlocybidæ*) were fully entered into. There had been no complaint of these insects by fruit-growers until last year, when some species occurred in such numbers that they even stopped picking. Besides mentioning results obtained in the treatment of these pests, Mr. Theobald discussed the parasites which affect the *Typhlocybidæ*, amongst the most interesting being some small Proctotrupids which cause "parasitic castration," one genus, *Aphelopus*, having occurred during the past year in such numbers that the opinion was expressed that the "hoppers" must have been nearly stamped out in places.

A long paper followed on the American gooseberry mildew, by Mr. Salmon, who explained its life-history and the great damage it does, and dwelt upon the necessity of immediate steps being taken to stamp it out and prevent importation. The paper caused some discussion, in which Profs. Middleton, Percival, and Fisher joined.

The secretary (Mr. Collinge) then gave a short and concise description of his successful extermination of the black-currant gall mite by means of sulphur and lime. Dr. MacDougall read a paper on parthenogenesis in the pine sawfly, and then gave an account of an extremely interesting piece of work on the length of life of *Calandra granaria*. At the afternoon sitting Mr. Freeman dealt with the geographical distribution of rubber plants, and incidentally stated that the output last year was 70,000 tons, valued at 30,000,000. Of this, 63 per cent. came from tropical America and 34 per cent. from tropical Africa, the remainder from Asia, the output of cultivated rubber being only $1\frac{1}{2}$ per cent. to 2 per cent. of the world's output.

Mr. E. R. Burdon then read a paper on the spruce-gall and larch-blight diseases caused by Chermes, and traced the connection between the two aphides and their migrations.

The day's proceedings terminated with a paper by Mr. F. V. Theobald on the insect pests of the British East Africa Protectorate, giving an account of the chief insect pests received from the Imperial Department of Agriculture. The most interesting is the diamond-back moth, which is thought to have been introduced into Africa, but which Mr. Theobald believes to be indigenous, in which Prof. Carpenter entirely agreed.